

**Notice of Allowability**

Application No.

09/914,704

Applicant(s)

DYCK ET AL.

Examiner

Krishnan S. Menon

Art Unit

1723

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment of 5/20/05.
2. ☒ The allowed claim(s) is/are 1,2,19-23 and 25-44; RENUMBERED 1-27.
3. ☐ The drawings filed on \_\_\_\_\_ are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date \_\_\_\_\_
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

### **EXAMINER'S AMENDMENT**

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ashley Pizzner on 7/15/05.

The application has been amended as follows:

A list of amended claims is attached at the end of this action starting on a fresh page.

Claims 1, 29 and 35 were amended to remove certain errors in the structural formula and to more clearly define the invention. Particularly, m was changed from  $m=0, 1 \text{ or } 2$  to  $m = 1 \text{ or } 2$ , because the structure with  $m=0$  does not be a polyether ketone as claimed.

### ***Allowable Subject Matter***

Pending Claims 1, 2, 19-23 and 25-44 are allowed.

The following is an examiner's statement of reasons for allowance:

The closest prior arts are Ozcayir'334, Kawakami'695 and Bikson'454. None of these references teach a polyether ketone of the structural formula as in the independent claim 1 when  $n=1-3$  and  $m=1 \text{ or } 2$ . All other claims depend from claim 1.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Corrected 892: Notice of References Cited.

The 892 of 12/8/03 erroneously included the reference Kawakami (US 4,971,695), which was presented by the applicant in the IDS of 8/31/01. Therefore, a new 892, with this reference removed to avoid duplication in the printed patent, is attached herewith. This new 892 will supercede the 892 of 12/8/03.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Krishnan S. Menon whose telephone number is 571-272-1143. The examiner can normally be reached on 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda L. Walker can be reached on 571-272-1151. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Krishnan S. Menon  
Patent Examiner  
7/15/05

**Amended Claims List**

1. (Currently amended) A sulfonated aromatic polyetherketone polymer ~~having a backbone and the polymer comprising the repeating structural unit of the formula (I)~~  
~~-O-Ar<sup>1</sup>(SO<sub>3</sub>R)<sub>n</sub>-C(CF<sub>3</sub>)<sub>2</sub>-Ar<sup>1</sup>(SO<sub>3</sub>R)<sub>n</sub>-O-Ar<sup>2</sup>-(X-Ar<sup>2</sup>)<sub>m</sub>-~~ (I),  
 in which Ar<sup>1</sup> and Ar<sup>2</sup> are, independently of one another, divalent aromatic or heteroaromatic radicals which are optionally substituted by one or more monovalent organic groups which are inert under the conditions of use or sulfonic acid groups, R is hydrogen, an alkali metal or alkaline earth metal ion or an ammonium ion, n is present and is an integer ~~up to~~ from 1 to 3, m is ~~0, 1 or 2~~ 1 or 2 and X is a -CO-, -O-, -C<sub>p</sub>H<sub>2p</sub>-, ~~[[C<sub>p</sub>H<sub>2p-1</sub>]]~~ -C<sub>p</sub>F<sub>2p</sub>- or -S- group, in which p is an integer from 1 to 10 and which has an ion exchange capacity of between 0.5 and 3.0 meq (-SO<sub>3</sub>H)/g of polymer and ~~with the proviso that at least one SO<sub>3</sub>R group is present in said backbone.~~
2. (Original) A sulfonated aromatic polymer as claimed in claim 1, which besides the repeating structural unit of the formula I, comprises the repeating structural unit of the formula II  
~~-O-Ar<sup>1</sup>(SO<sub>3</sub>R)<sub>n</sub>-C(CH<sub>3</sub>)<sub>2</sub>-Ar<sup>1</sup>(SO<sub>3</sub>R)<sub>n</sub>-O-Ar<sup>2</sup>-(Y-Ar<sup>2</sup>)<sub>m</sub>-~~ (II),  
 in which Ar<sup>1</sup>, Ar<sup>2</sup>, R, m and n have the meaning defined in claim 1, and Y is a -CO-, -O-, -C<sub>p</sub>H<sub>2p</sub>-, -C<sub>p</sub>F<sub>2p</sub>-, -S- or -SO<sub>2</sub>- group in which p is an integer from 1 to 10.

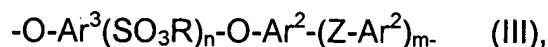
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3-18. (Cancelled)

19. (Previously presented) The sulfonated aromatic polymer as claimed in claim 1, wherein X is -CO-.

20. (Previously presented) The sulfonated aromatic polymer as claimed in claim 1, wherein Ar<sup>1</sup> and Ar<sup>2</sup> are, independently of one another, phenylene, naphthylene or biphenylene.

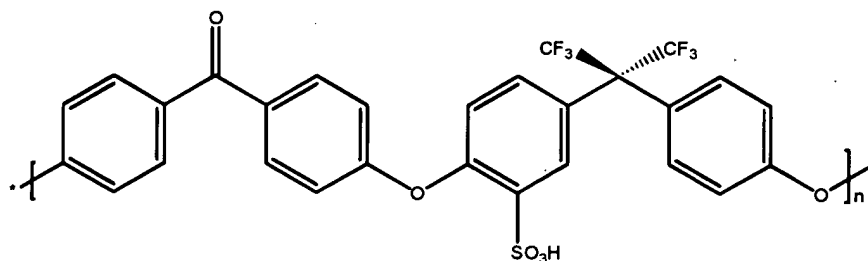
21. (Previously presented) The sulfonated aromatic polymer as claimed in claim 1, which further comprises the repeating structural unit of the formula III



in which Ar<sup>2</sup>, R, m and n have the meaning defined in claim 1, Z is a -CO-, -O-, -C<sub>p</sub>H<sub>2p</sub>-, -C<sub>p</sub>F<sub>2p</sub>-, -S- or -SO<sub>2</sub>- group in which p is an integer from 1 to 10, and Ar<sup>3</sup> is a divalent aromatic or heteroaromatic radical which is optionally substituted by one or more monovalent organic groups which are inert under the conditions of use.

22. (Previously presented) The sulfonated aromatic polymer as claimed in claim 21, wherein the molar proportion of the repeating structural unit of the formula I is 10-50% and the molar proportion of the repeating structural unit of the formula III is 90-50%.

23. (Previously presented ) sulfonated A sulfonated aromatic polymer which consists essentially of the repeating structural unit of the following formula:

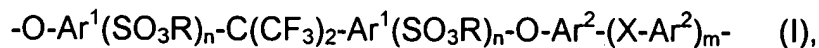


Claim 24 cancelled

25. (Previously presented) A membrane comprising the sulfonated polymer as claimed in claim 1.
26. (Previously presented) The membrane as claimed in claim 25, which has a proton conductivity in contact with liquid water, determined by impedance spectroscopy in water at 80°C, of between 120 and 350 mS/cm.
27. (Previously presented) The membrane as claimed in claim 25, which comprises as further polymer component a sulfonated, aminated or else underivatized aromatic polymer.
28. (Previously presented) The membrane as claimed in claim 25, which has a thickness of between 10 and 150  $\mu\text{m}$ .
29. (Currently amended) A method for producing a membrane as claimed in claim 25, comprising the steps of:
- (i) dissolving a sulfonated aromatic polymer comprising the repeating

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structural unit of the formula (I) or its salt form,



in which  $\text{Ar}^1$  and  $\text{Ar}^2$  are, independently of one another, divalent aromatic or heteroaromatic radicals which are optionally substituted by one or more monovalent organic groups which are inert under the conditions of use or sulfonic acid groups, R is hydrogen, an alkali metal or alkaline earth metal ion or an ammonium ion,  $n$  is present and is an integer up is an integer from 1 to 3,  ~~$m$  is 0,~~  $m$  is 1 or 2 and X is a  $-\text{CO}-$ ,  $-\text{O}-$ ,  $-\text{C}_p\text{H}_{2p}-$ ,  $-\text{C}_p\text{F}_{2p}-$  or  $-\text{S}-$  group, in which  $p$  is an integer from 1 to 10,

in an aprotic organic solvent,

- (ii) spreading the solution on a support, and
- (iii) evaporating the solvent to form the membrane.

30. (Previously presented) The method for producing a membrane as claimed in claim 29, wherein the solution is DMF, DMAC, NMP or DMSO and said polymer has a concentration being between 3 and 30% by weight.

31. (Previously presented) The method for producing a membrane as claimed in claim 29, wherein the salt forms of the polymer are employed and wherein the salt forms can be converted into the acid form by treatment with an acid after production of the membrane.



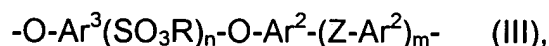
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32. (Previously presented) The method for producing a membrane as claimed in claim 29, wherein the remaining solvent or salts are removed after the membrane production by a washing medium.

33. (Previously presented) The sulfonated aromatic polymer as claimed in claim 2, wherein  $\text{Ar}^1$  and  $\text{Ar}^2$  are, independently of one another, 1,3- phenylene or 1,4- phenylene.

34. (Previously presented) The sulfonated aromatic polymer as claimed in claim 1, wherein  $\text{Ar}^1$  and  $\text{Ar}^2$  are, independently of one another, 1,3- phenylene or 1,4- phenylene.

35. (Currently amended) The sulfonated aromatic polymer as claimed in claim 2, which further comprises the repeating structural unit of the formula III



in which  $\text{Ar}^2$  is a divalent aromatic or heteroaromatic radicals which is optionally substituted by one or more monovalent organic groups which are inert under the conditions of use or sulfonic acid groups,

R is hydrogen, an alkali metal or alkaline earth metal ion or an ammonium ion,

~~n is present and is an integer up to 3,~~ n is an integer from 1 to 3, ~~m is 0,~~ m is 1 or 2,

Z is a  $-\text{CO}-$ ,  $-\text{O}-$ ,  $-\text{C}_p\text{H}_{2p}-$ ,  $-\text{C}_p\text{F}_{2p}-$ ,  $-\text{S}-$  or  $-\text{SO}_2-$  group in which p is an integer from 1 to 10, and  $\text{Ar}^3$  is a divalent aromatic or heteroaromatic radical which is optionally substituted by one or more monovalent organic groups which are inert under the conditions of use.

36. (Previously presented)The sulfonated aromatic polymer as claimed in claim 35, wherein the molar proportion of the repeating structural unit of the formula I and formula II is 10-50% and the molar proportion of the repeating structural unit of the formula III is 90-50%.
37. (Previously presented)The sulfonated polymer as claimed in claim 36, which has an ion exchange capacity of between 1.0 and 2.0 meq (-SO<sub>3</sub>H)/g of polymer.
38. (Previously presented)The membrane as claimed in claim 25, which comprises as further polymer a polyether sulfone, polysulfone, polybenzimidazole or polyether ketone and the membrane has a thickness of between 20 and 60  $\mu$ m.
39. (Previously presented)The membrane as claimed in claim 31, wherein said salt forms of the polymer are NH<sub>4</sub>, Li, Na or K salts.
40. (Previously presented)The method as claimed in claim 32, wherein said washing medium is a 5% strength mineral acid in water.
41. (Previously presented)A fuel cell which comprises the membrane as claimed in claim 25.
42. (Previously presented)The fuel cell as claimed in claim 41, wherein the fuel cell is a direct methanol fuel cell.
43. (Previously presented)A high-performance capacitor which comprises the membrane as claimed in claim 25.

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44. (Previously presented) A dialysis apparatus which comprises the membrane as claimed in claim 25.



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